Maryland Epidemiology and Genotyping Update

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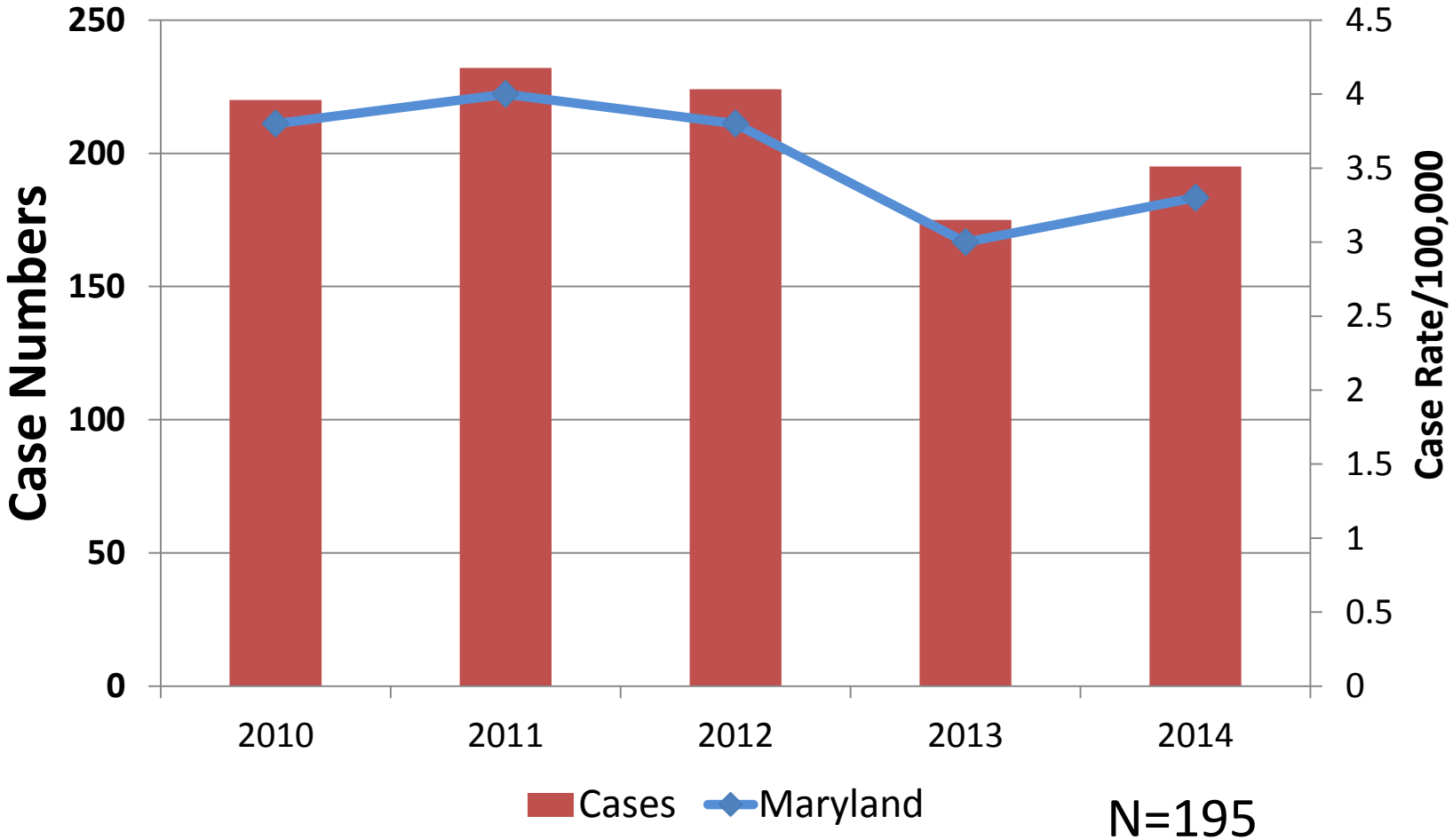
Maryland Department of Health & Mental Hygiene

TB Annual Meeting
March 26, 2015

Presentation Outline

- Maryland TB Epidemiology (2014)
  - Maryland TB numbers and trends
  - Country of origin
  - Demographics
  - Drug resistance
  - Risk factors
- TB Genotyping
  - Refresher on what genotyping is
  - Alerts
  - Uses

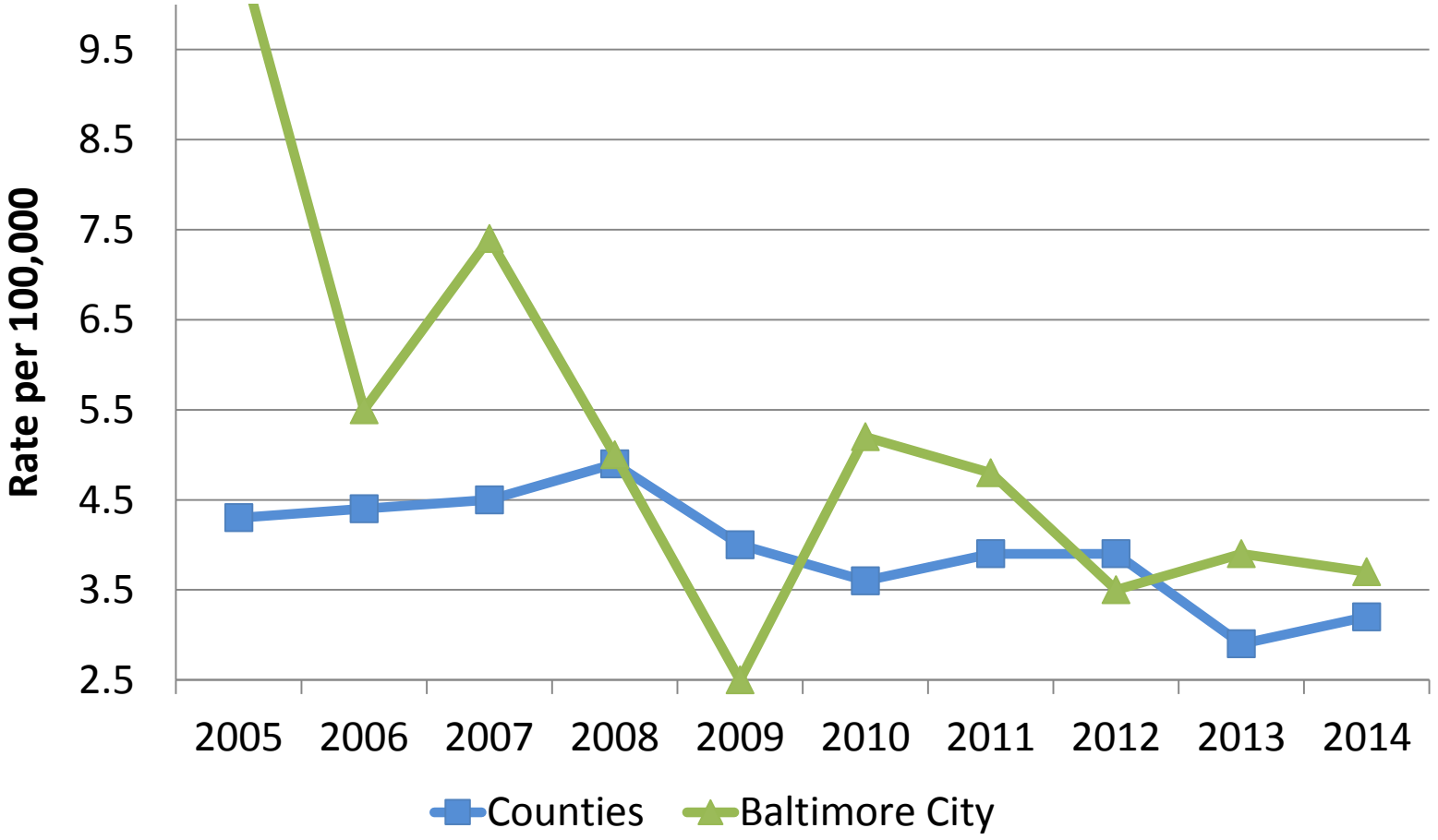
Maryland TB, 2010-2014



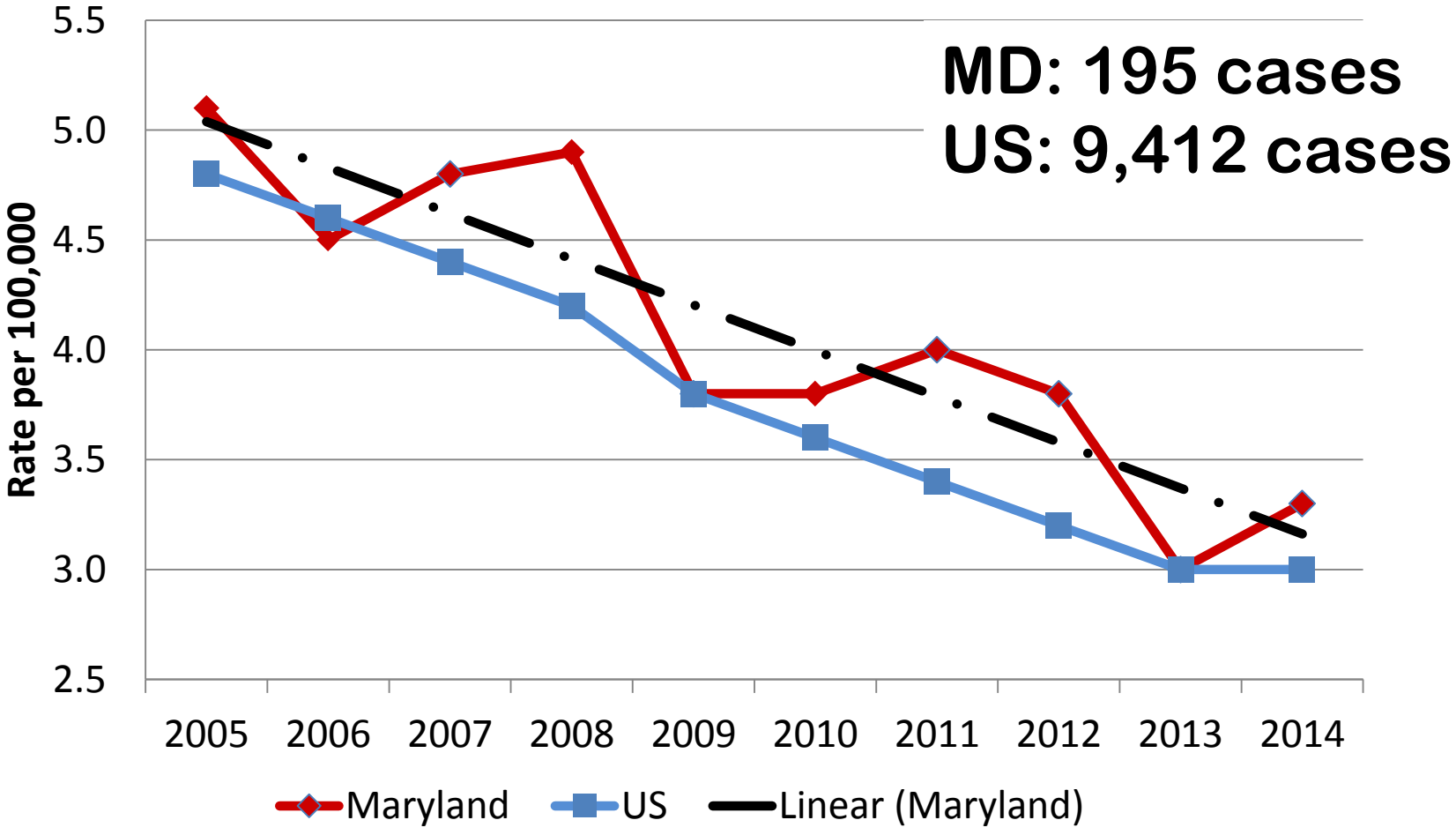
N=195

Rate= 3.3/100,000

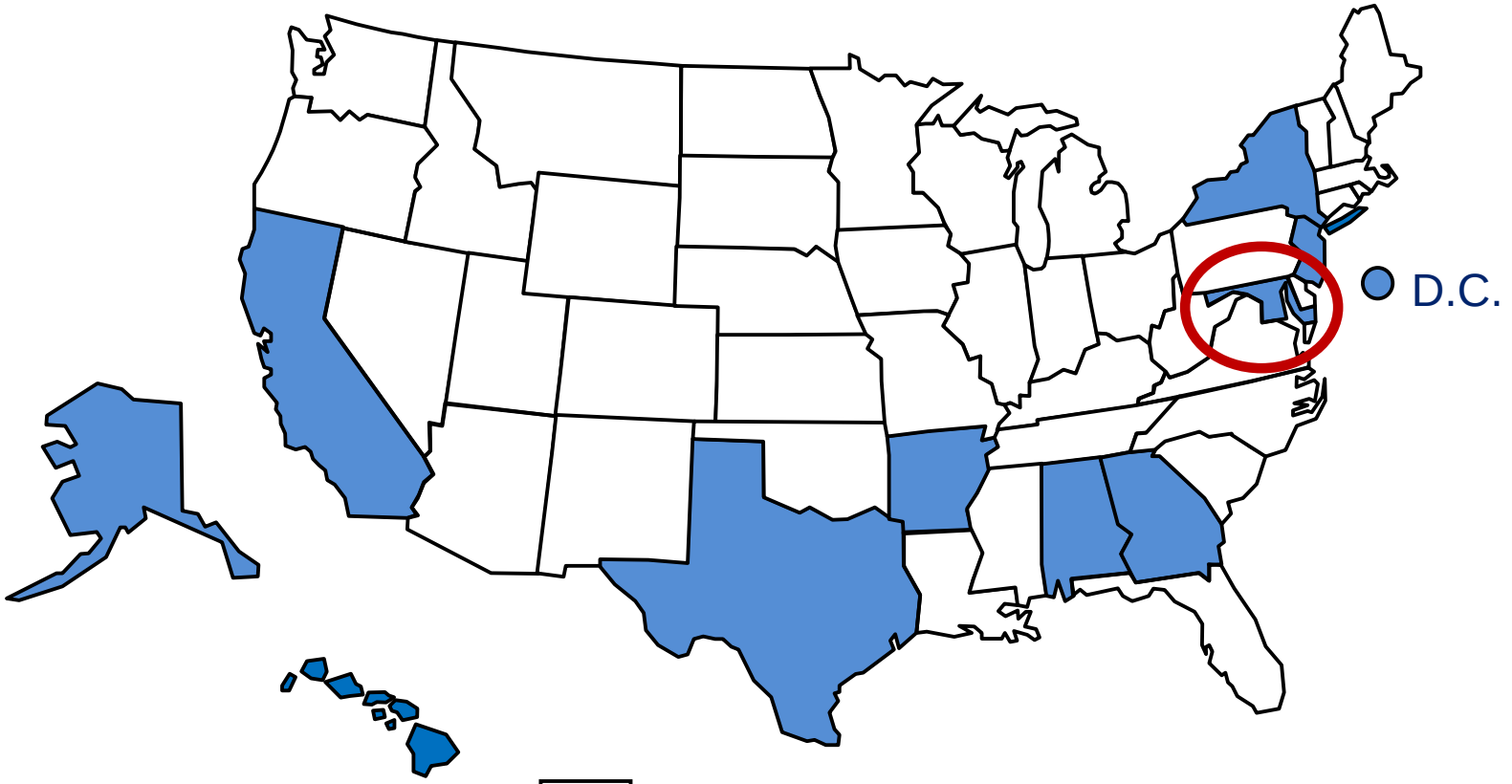
TB Rates, Maryland Counties, Baltimore City, US (2005-2014)



Maryland, Maryland Trend, and US TB Rates, 2005-2014



TB Case Rates per 100,000, United States, 2014*



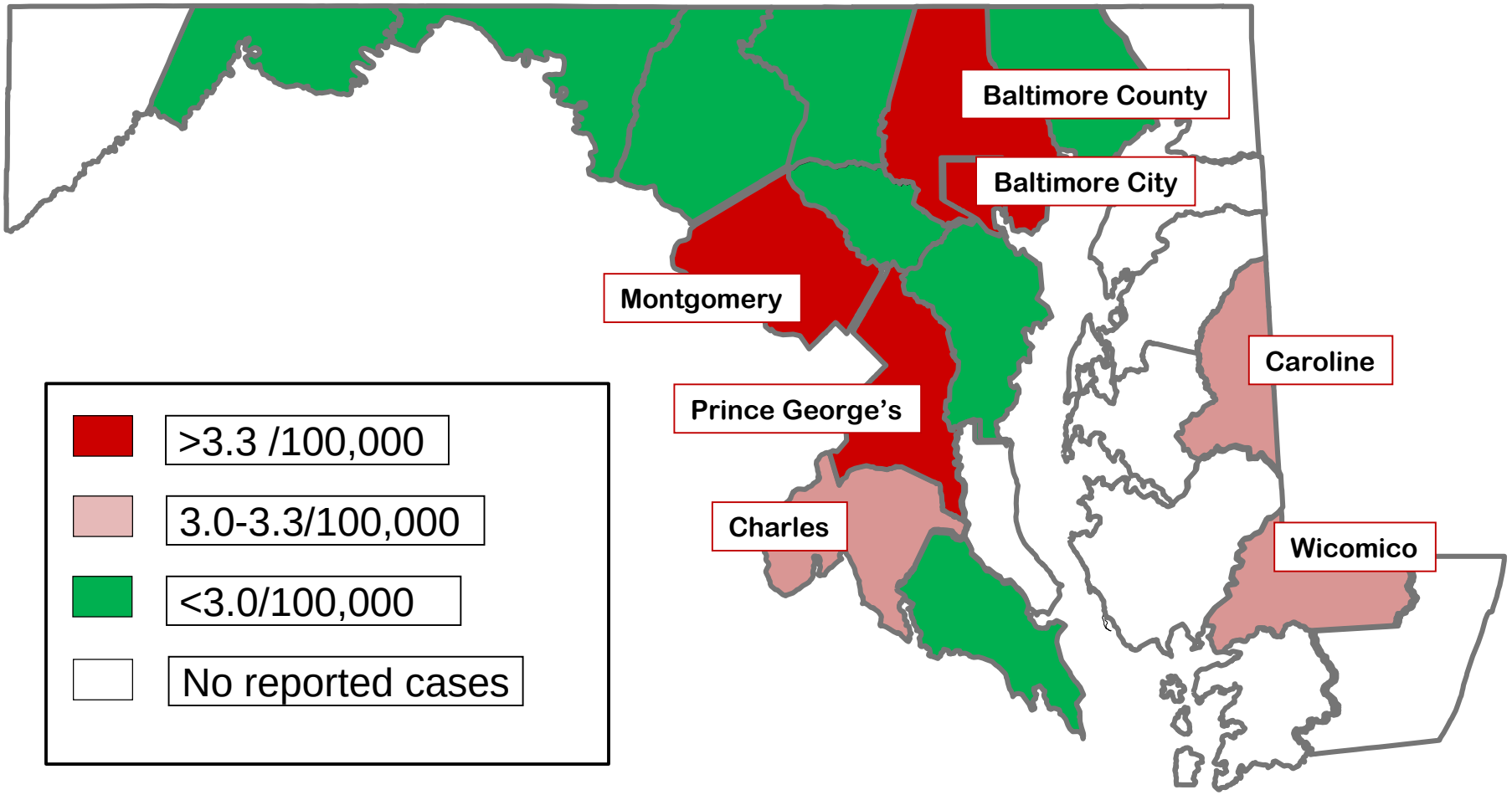
Case no. 9,412

≤ 3.0 (2014 *provisional national average)

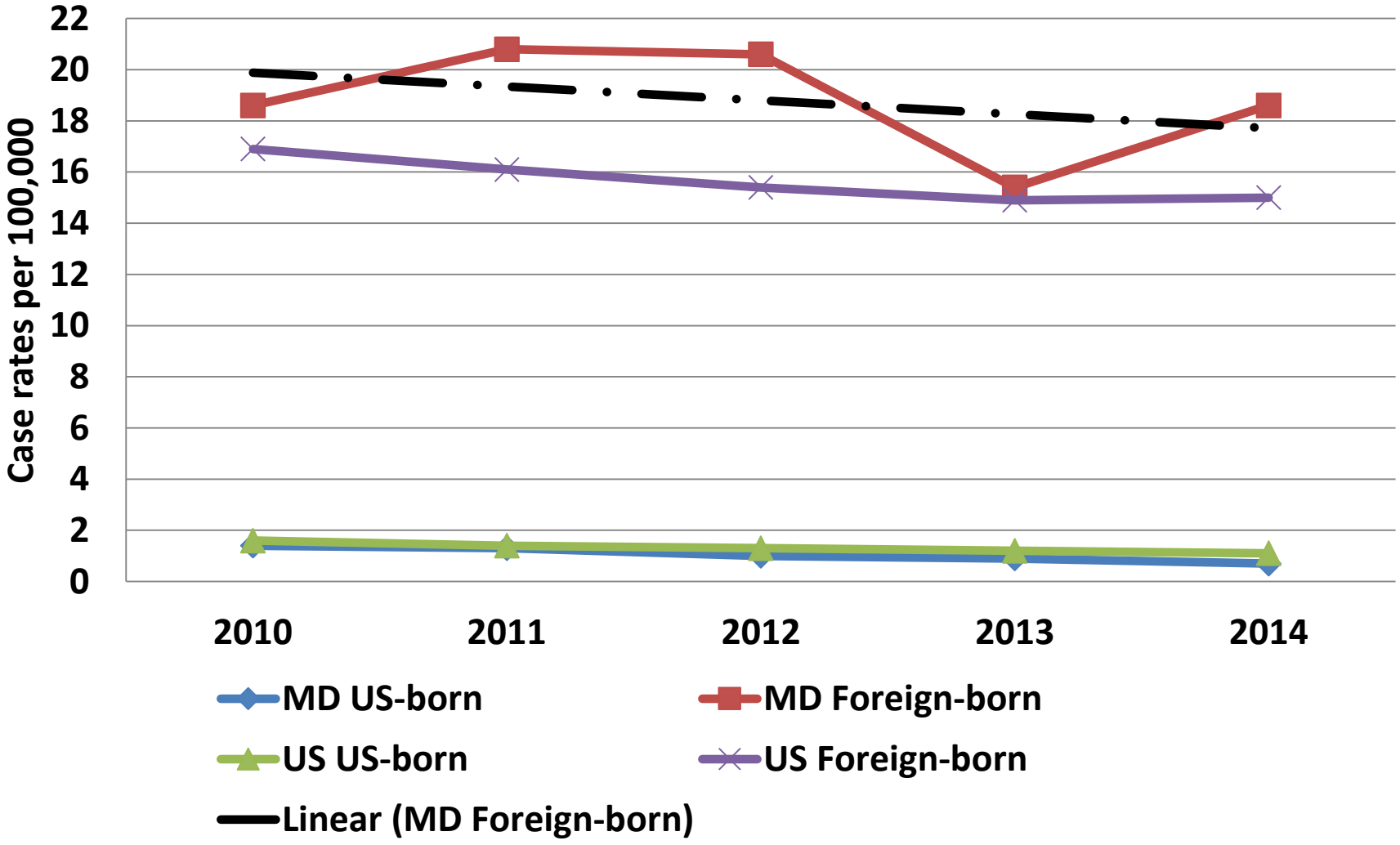
>3.0

CDC, 3/20/2015

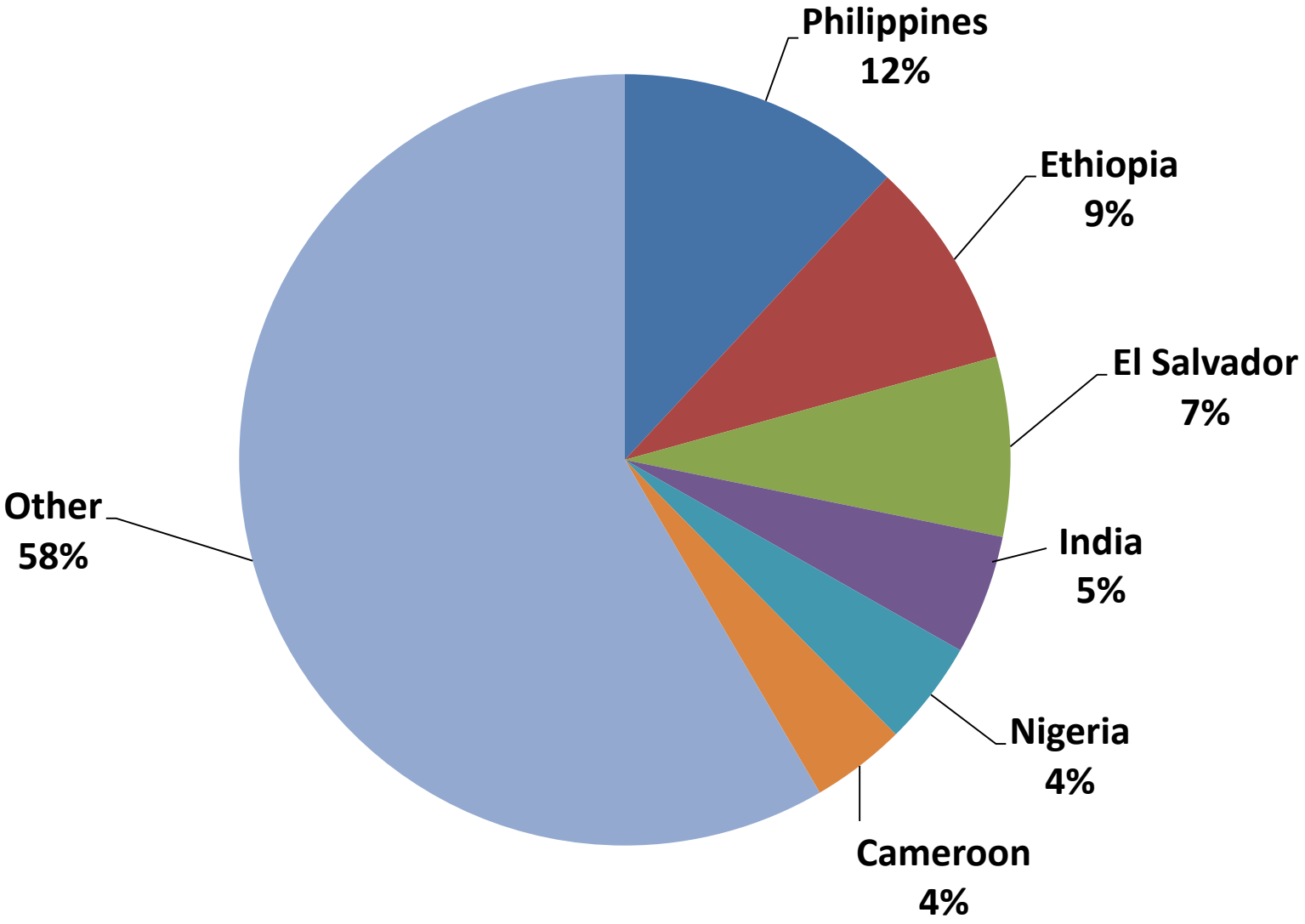
State TB Case Rates per 100,000 Population, by Jurisdiction, 2014



TB rates among US and foreign born, Maryland vs. US, 2014



6 Top Countries of Origin-MD, 2014

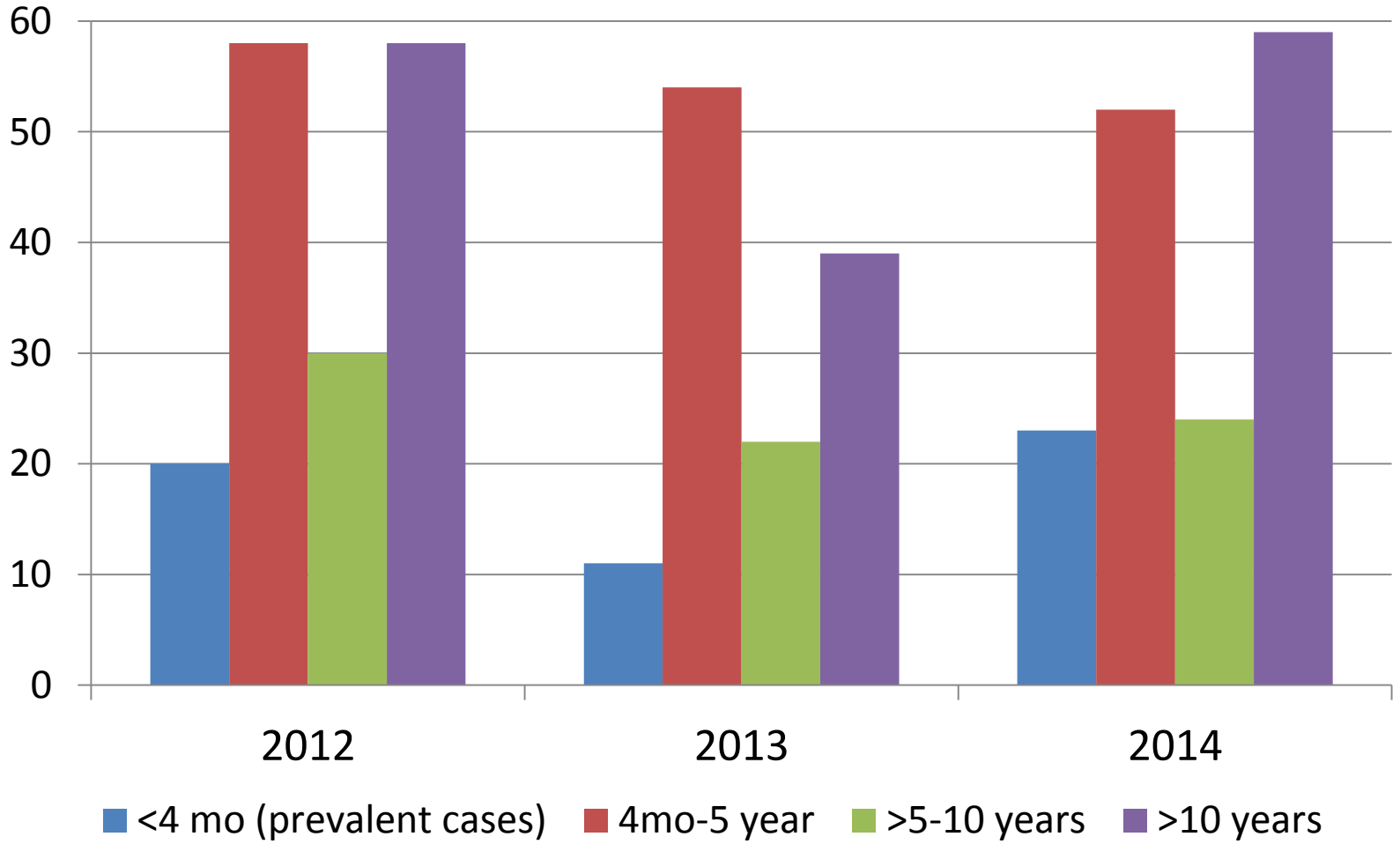


WHO Estimates of TB Incidence 2013

Country	Incidence/100,000
Philippines	292 (261-331)
Ethiopia	224 (188–276)
El Salvador	39 (35-42)
India	171 (162–184)
Nigeria	338 (194–506)
Cameroon	235 (210–265)

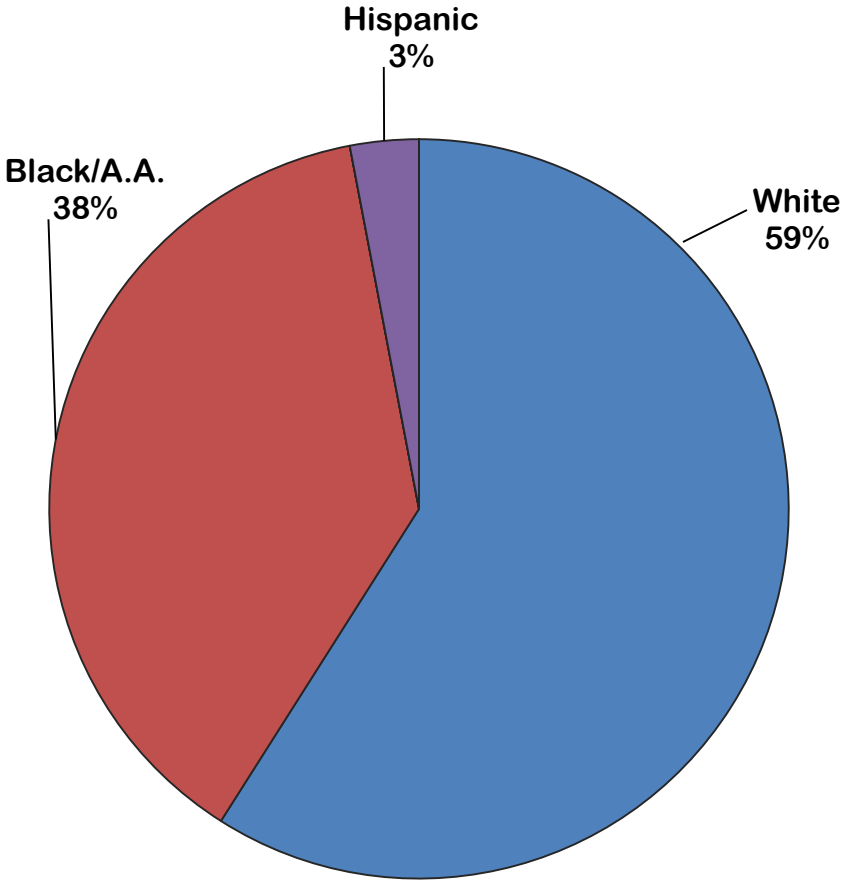
http://www.who.int/tb/publications/global_report/en/

Foreign-born TB Case Numbers, by Time from U.S. Arrival to Diagnosis, 2012-2014

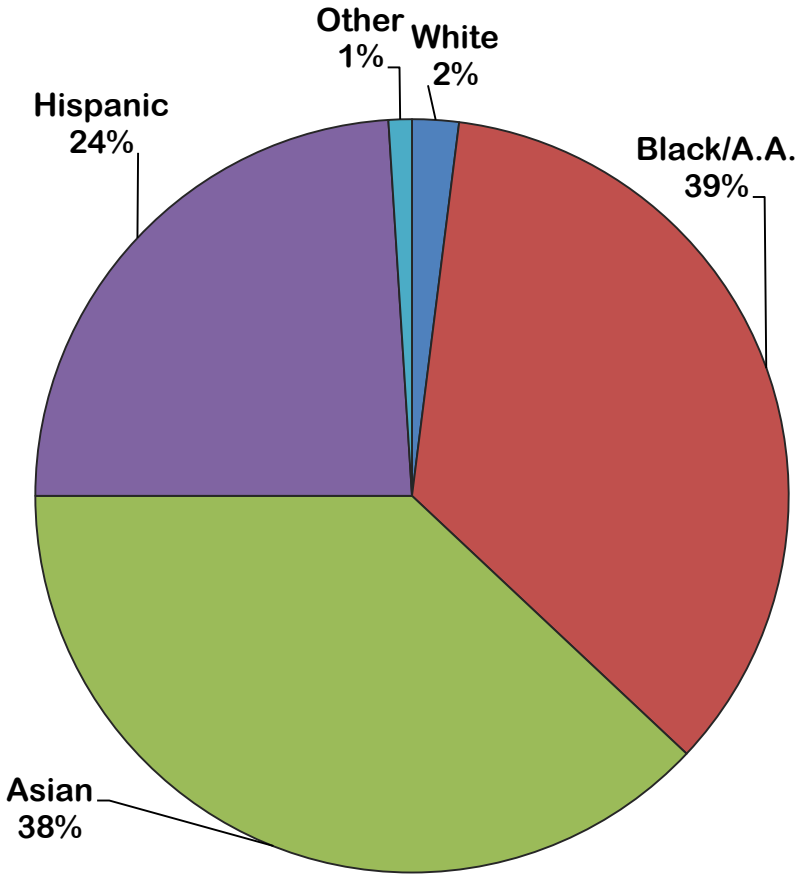


TB Cases by Race and Origin, 2014

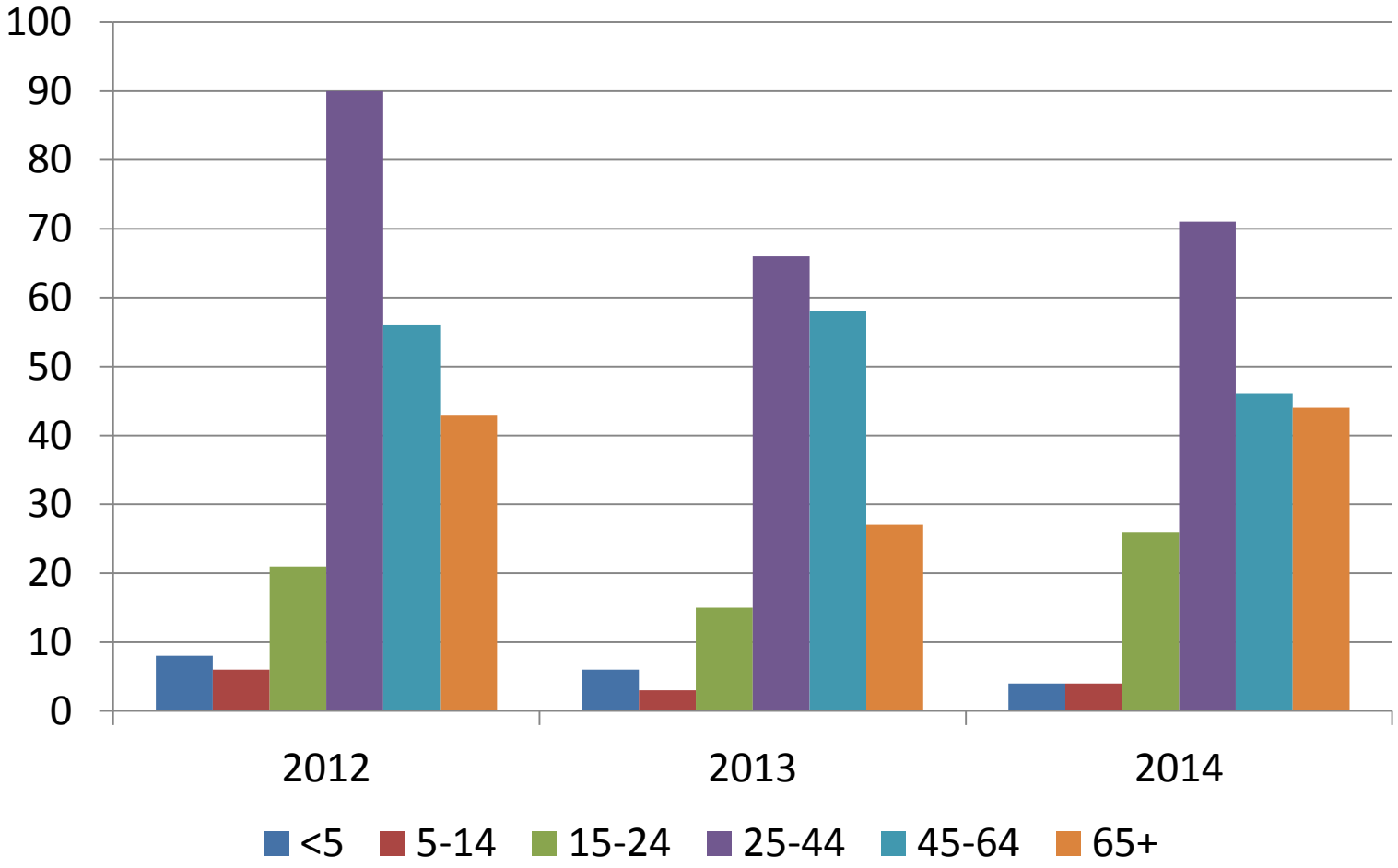
U.S. Born



Foreign Born



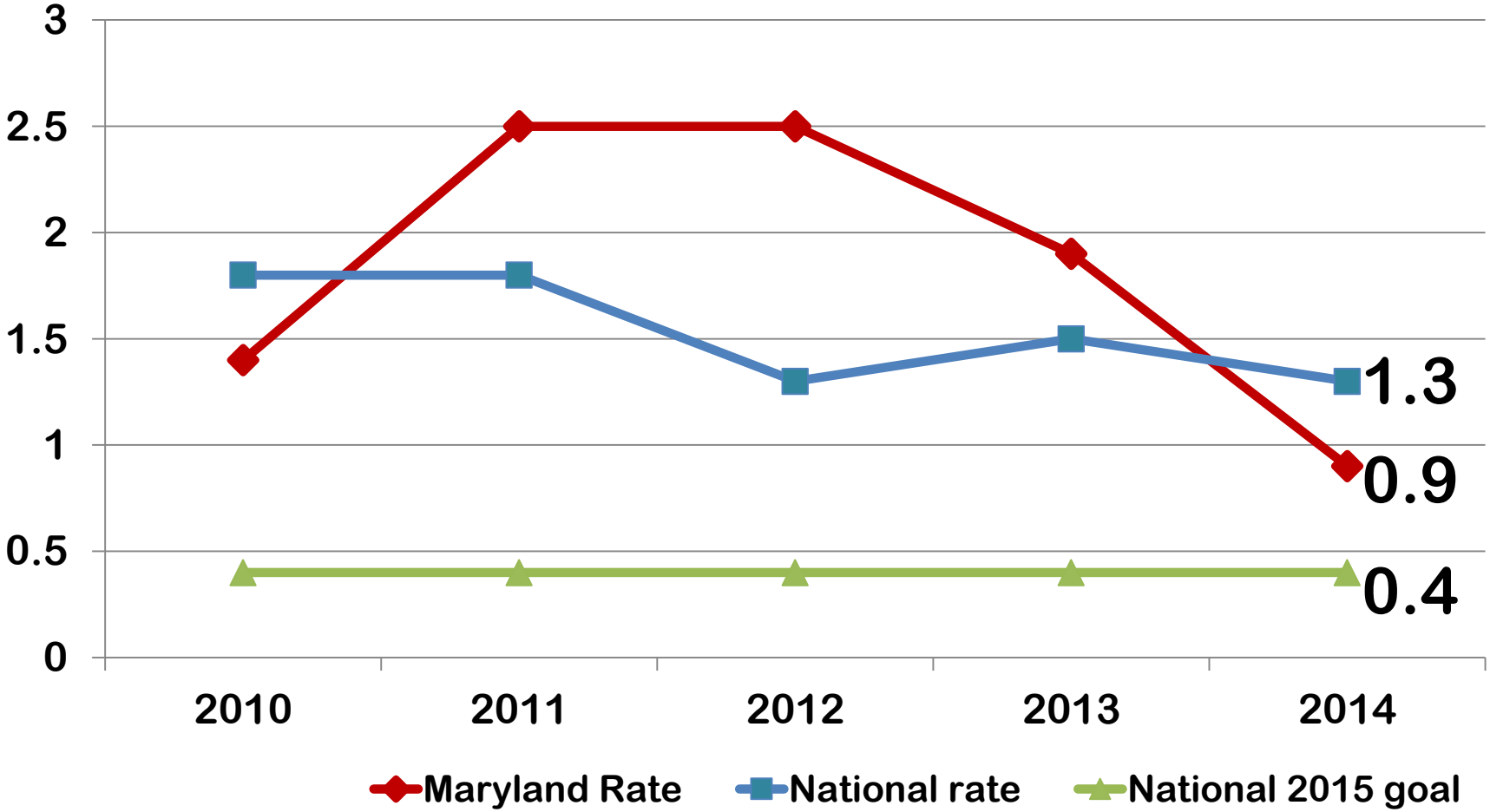
Cases by Age Group Maryland, 2010-2014



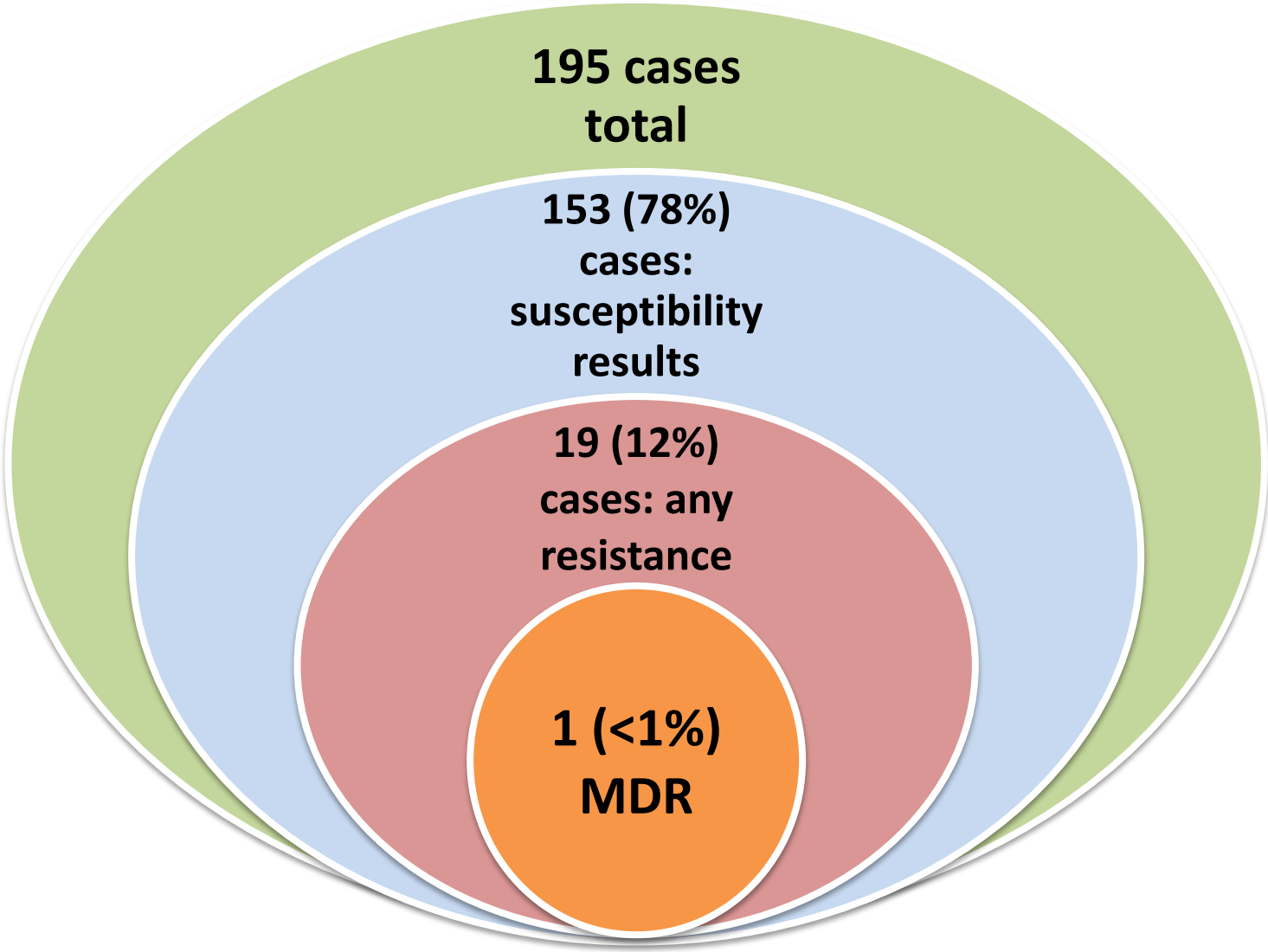
The Canary in the Coal Mine

- **Children under 5 years old**
  - At high risk for TB meningitis, disseminated TB
  - Disease can progress quickly
  - Important to find source case
    - Stop further transmission
  - Can represent undiagnosed adult cases

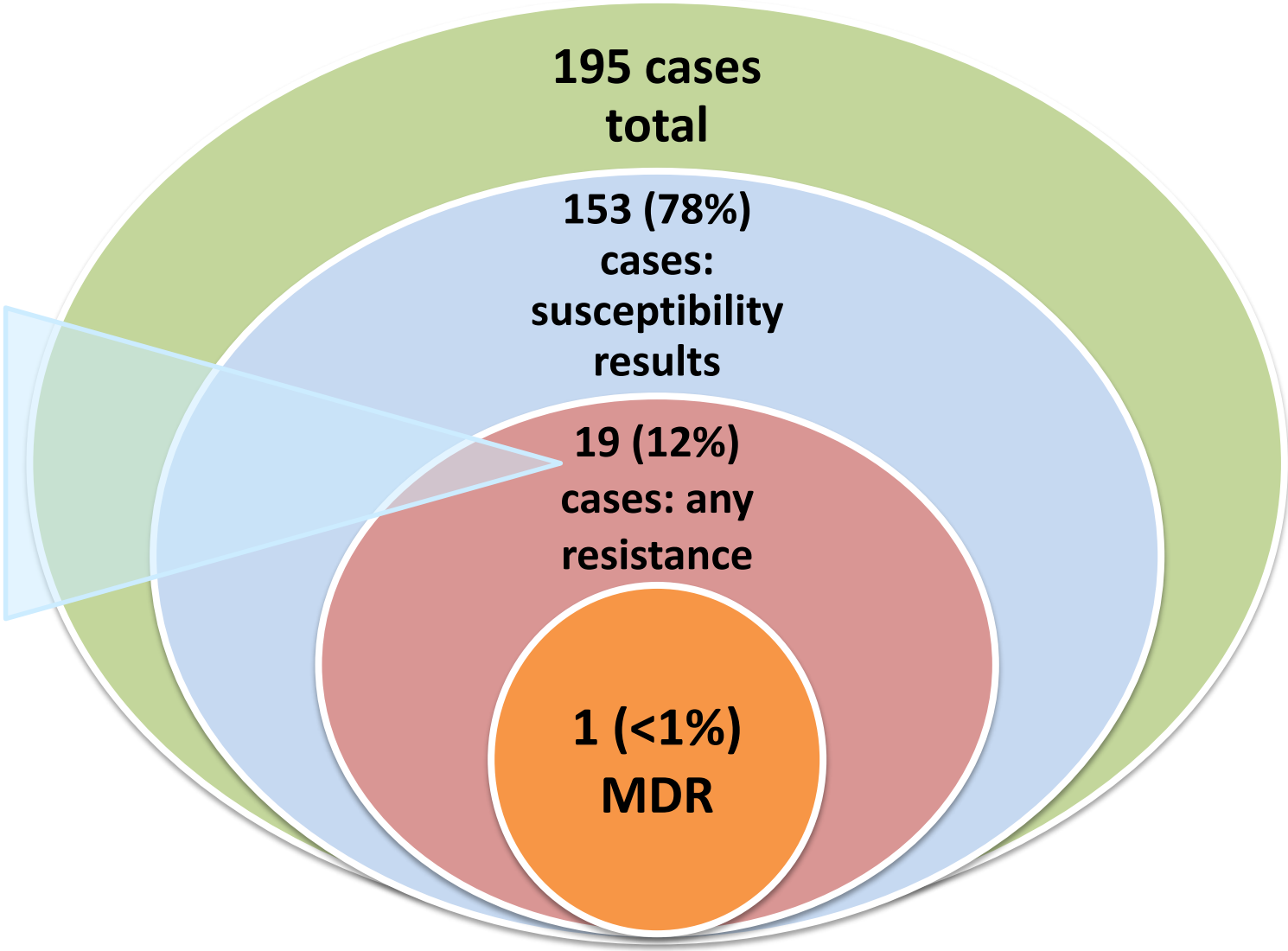
Case Rates per 100,000 in Children < 5 Years of Age; Maryland vs. US, 2010-2014



Maryland Drug Resistance, 2014



Maryland Drug Resistance, 2014



RIF -1
PZA – 6
INH – 15
EMB - 1

Starting Treatment with 4 Drugs

INH resistance

	Maryland (2014)	US (2013)
TOTAL:	7.7%	8.8%
US born:	4.0%	5.6%
Foreign born:	10.9%	10.5%

- **97%** of eligible Maryland patients started treatment with 4 drugs, vs. 87% in 2013 !!!!
- National goal is 93.4%

With Fewer Cases Why Are We Still Working So Hard?

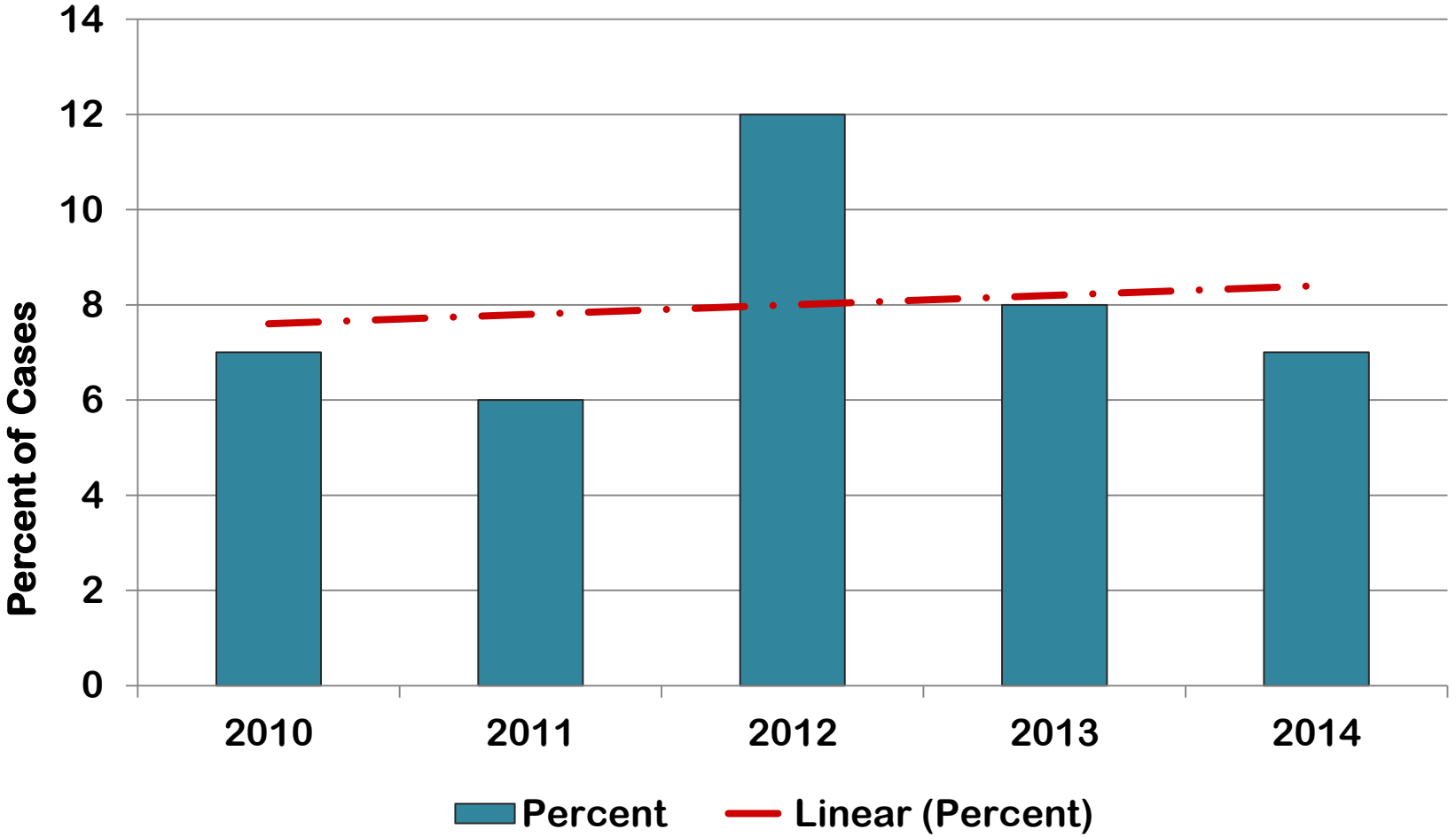
- Risk factors
  - Living and Occupation
  - Substance Use
  - TB HIV co-infection
  - Diabetes
- They are more complex!

TB Risk Factors: Living and Occupational

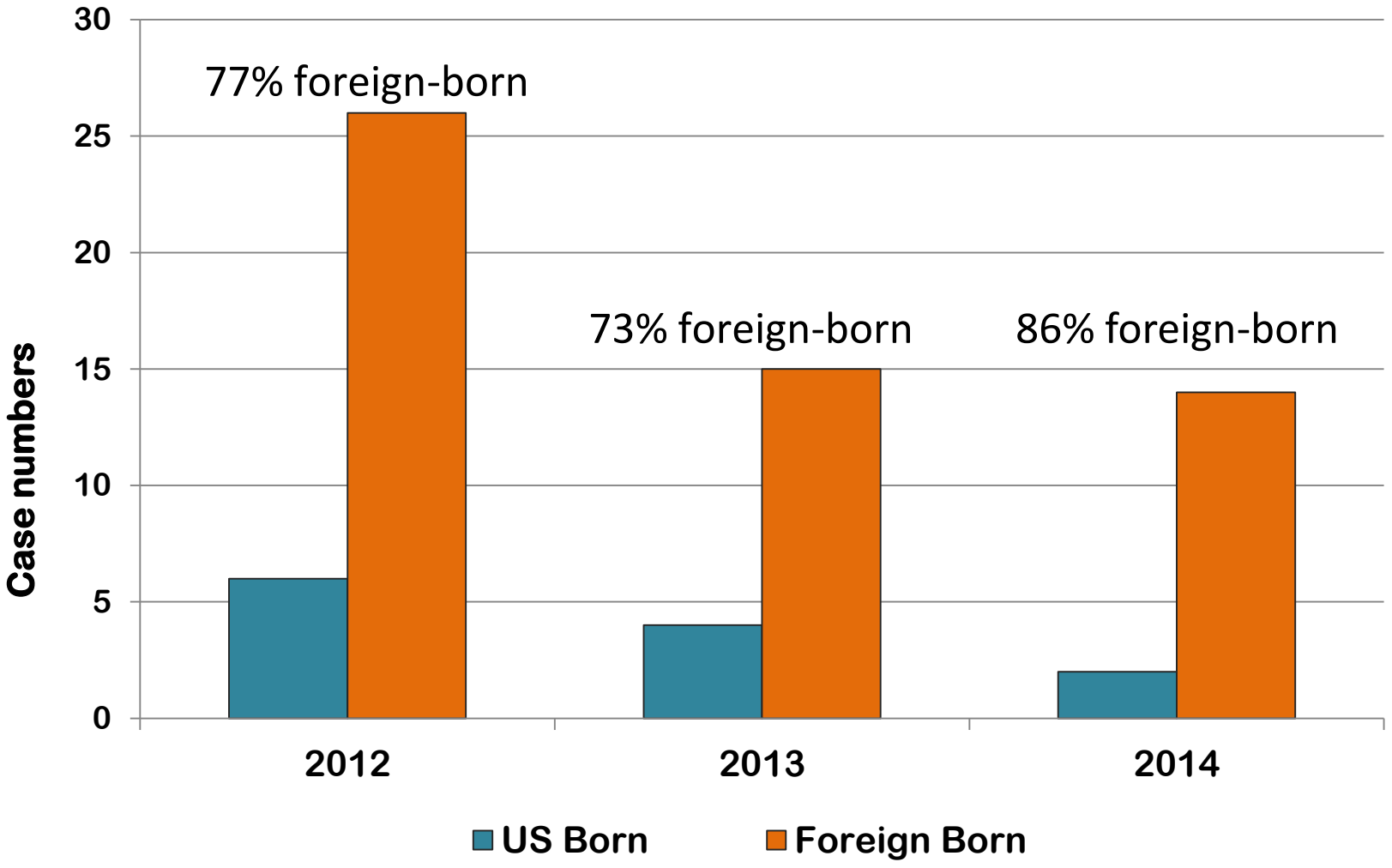
	2012	2013	2014	National
Congregate Setting				
Homeless	5%	3%	4%	5.5%
Corrections	0.5%	0%	1%	4.2%
Long Term Care	1%	1%	2.5%	2.2%
Substance abuse	9%	6%	6%	11-12%
Occupation				
Health Care	9%	3%	6%	4%*
Correctional	0.5%	0%	0%	0.1%*

*2013 National Data

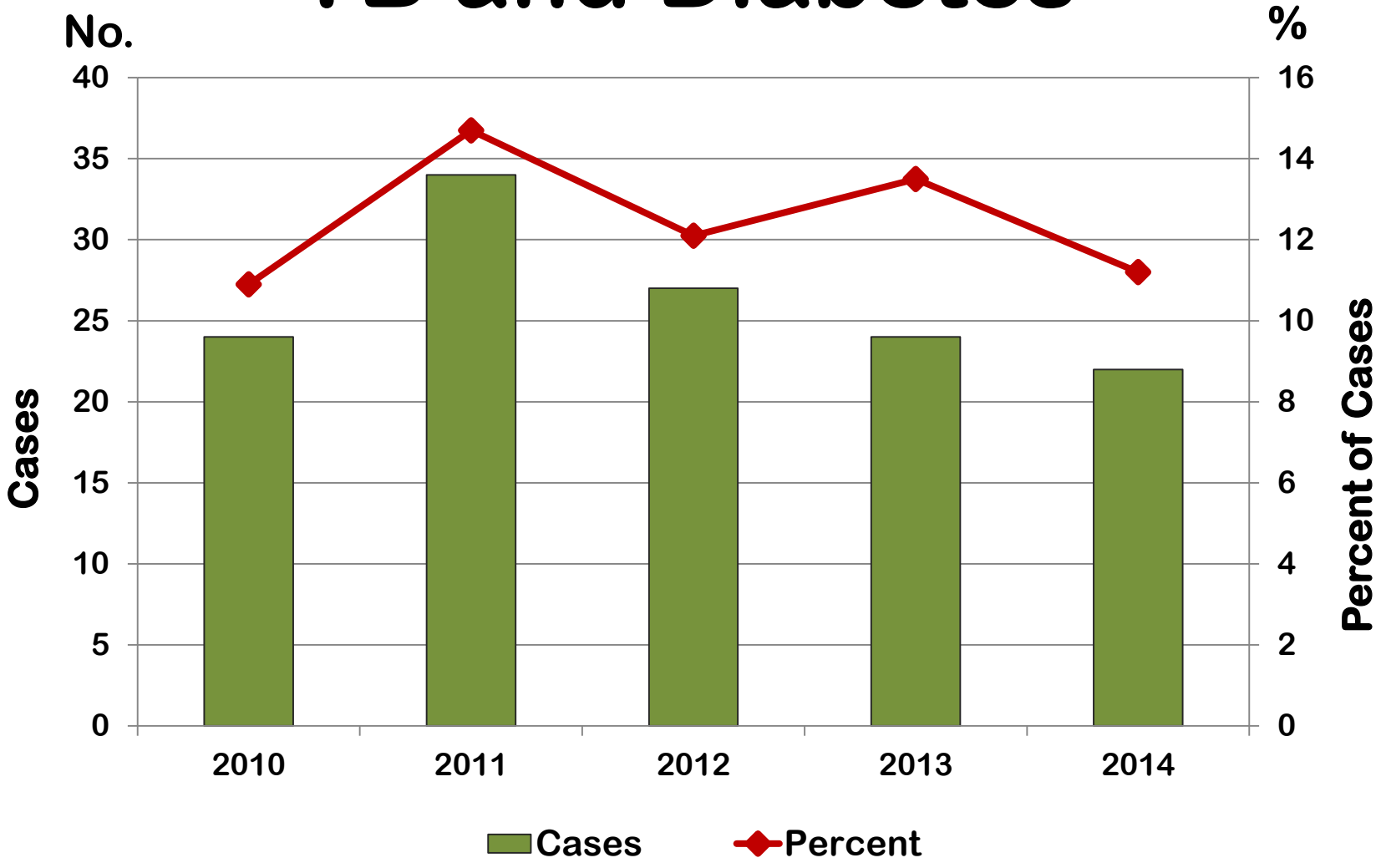
TB HIV Co-Infection Trends, 2010-2014



TB HIV Co-Infection, Origin of Birth



TB and Diabetes



Status of DOT in Maryland

Maryland Goal: 100%

Year	Self-Administered	Directly Observed	Both SAT & DOT	TOTAL	% DOT
2010	8	156	18	182	86%
2011	5	158	32	195	81%
2012	4	166	29	199	83%
2013	2	**135**	31	**168**	**80%**

Questions?

TB Genotyping

Role of TB Genotyping

- Use genetic patterns of specific parts of the *M. tuberculosis* organism to:
  - Identify and intervene in ongoing transmission (outbreaks)
  - Determine relapse versus reinfection
  - Identify or “confirm” false positive cultures

Mycobacterium tuberculosis "Isolate"

- Definition: a pure culture of *Mycobacterium tuberculosis* organism from a single patient

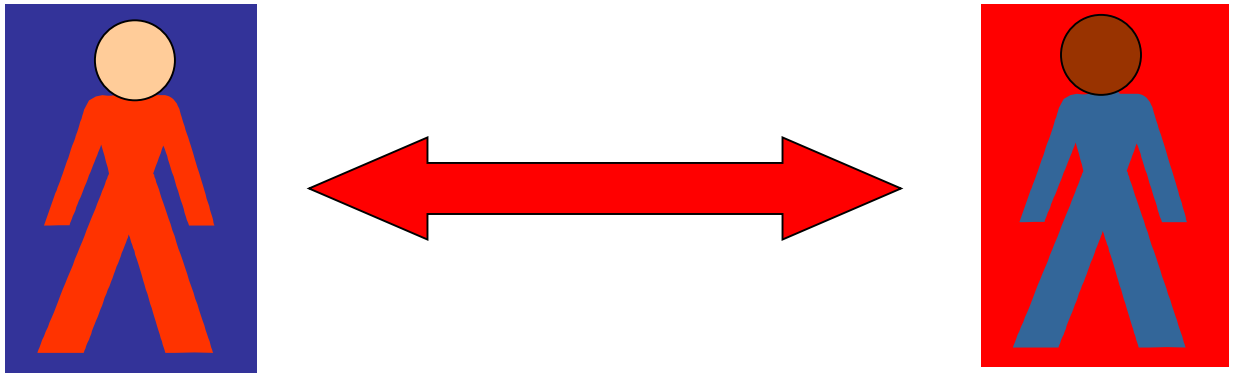
Genotyping terminology

Spoligotype	MIRU	MIRU2
777776777760601	224325153323	444234423337

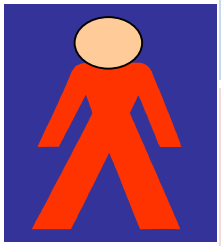
PCRType PCR00233

GENType G00011

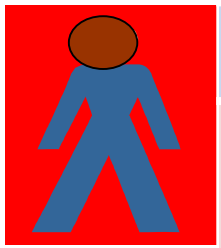
Genotype Cluster



When a TB case's isolate genotype matches at least one other TB case's isolate genotype



PCRType	GENType	Cluster Name
PCR00002	G01143	MD0002_001



PCRType	GENType	Cluster Name
PCR00002	G01143	MD0002_001

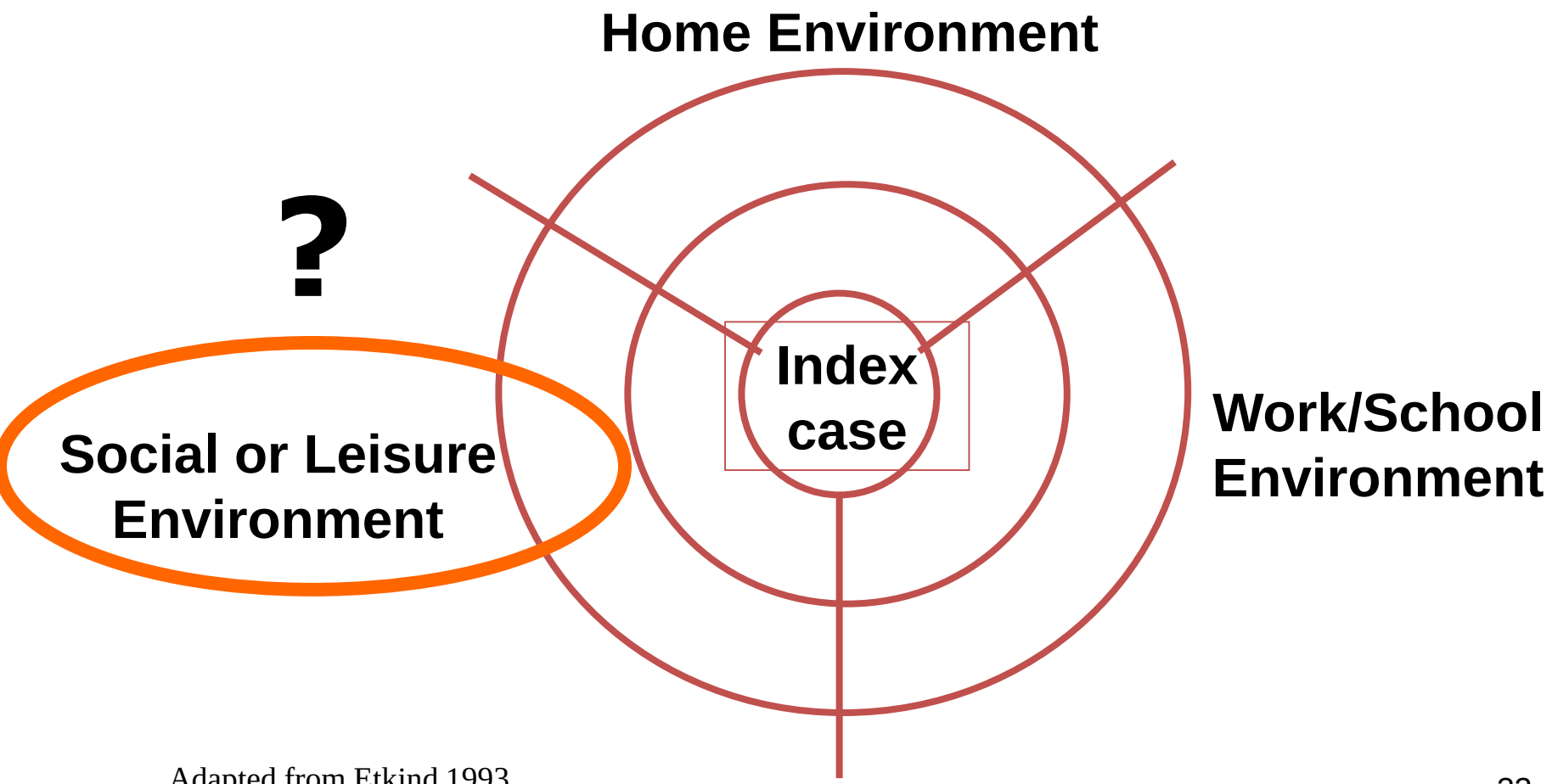
Epi-Links

- Epi-links are essential for determining on-going transmission
  - **Person**: named contacts; similar demographic and risk characteristics
  - **Place**: location where the TB patients spent time together
  - **Time**: exposure during infectious period

Epi Links ⟶ Genotype Cluster?

- Local Health Dept calls CTBCP
- Provider or ICP calls CTBCP
- CTBCP gets routine genotyping report from CDC (TB-GIMS) and calls LHD
- CDC (TB-GIMS) sends an “Alert”
- Laboratory calls CTBCP

Genotyping Can Enhance Contact Investigations

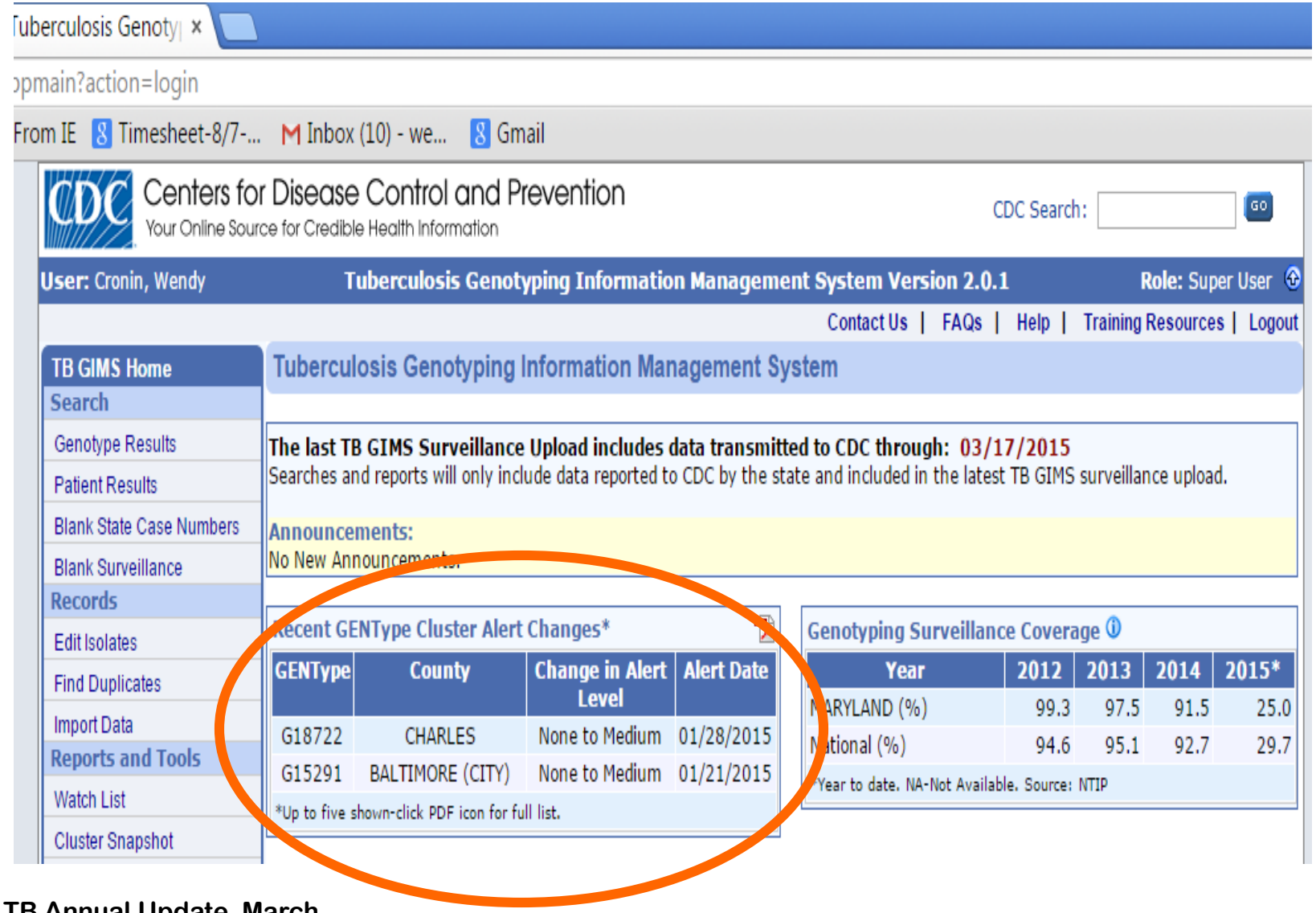


Adapted from Etkind 1993

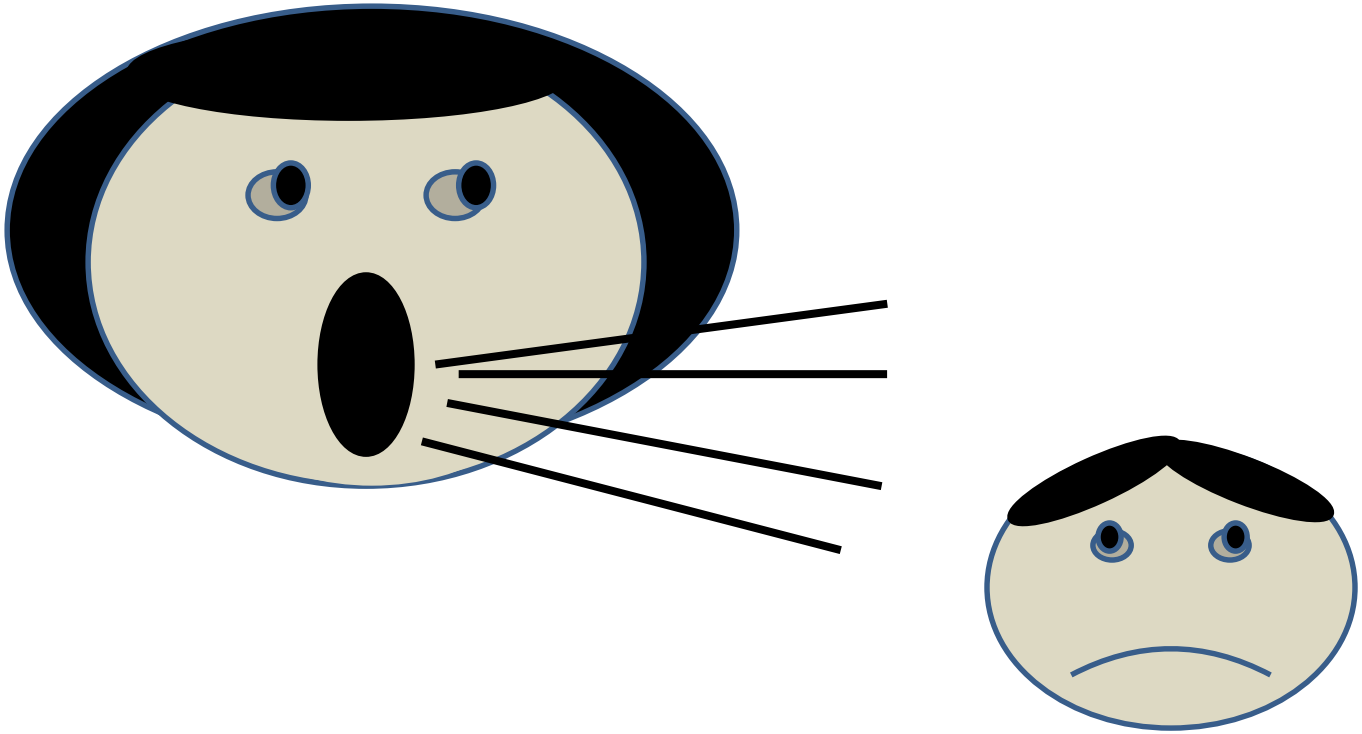
Genotype Cluster Alerts

- Statistical method performed by CDC (Log likelihood ratio)
- Low, Medium, High (recent transmission risk)
- Based on
  - Two or more cases
  - Geographic location (same county vs. US)
  - Time: 3 years or less
  - Change in number of patients in the cluster

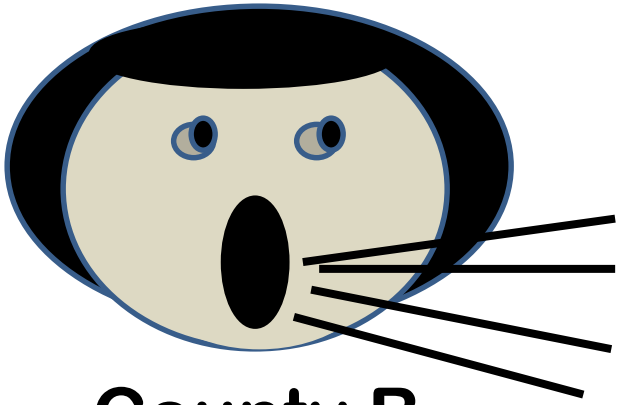
TB-GIMS


Tuberculosis Genoty
opmain?action=login
From IE
Timesheet-8/7-...
Inbox (10) - we...
Gmail
Centers for Disease Control and Prevention
Your Online Source for Credible Health Information
CDC Search:
GO
User: Cronin, Wendy
Tuberculosis Genotyping Information Management System Version 2.0.1
Role: Super User
Contact Us | FAQs | Help | Training Resources | Logout
TB GIMS Home
Search
Genotype Results
Patient Results
Blank State Case Numbers
Blank Surveillance
Records
Edit Isolates
Find Duplicates
Import Data
Reports and Tools
Watch List
Cluster Snapshot
Tuberculosis Genotyping Information Management System
The last TB GIMS Surveillance Upload includes data transmitted to CDC through: 03/17/2015
Searches and reports will only include data reported to CDC by the state and included in the latest TB GIMS surveillance upload.
Announcements:
No New Announcements
Recent GENType Cluster Alert Changes*
GENType
County
Change in Alert Level
Alert Date
G18722
CHARLES
None to Medium
01/28/2015
G15291
BALTIMORE (CITY)
None to Medium
01/21/2015
*Up to five shown-click PDF icon for full list.
Genotyping Surveillance Coverage
Year
2012
2013
2014
2015*
ARYLAND (%)
99.3
97.5
91.5
25.0
tional (%)
94.6
95.1
92.7
29.7
Year to date. NA-Not Available. Source: NTIP

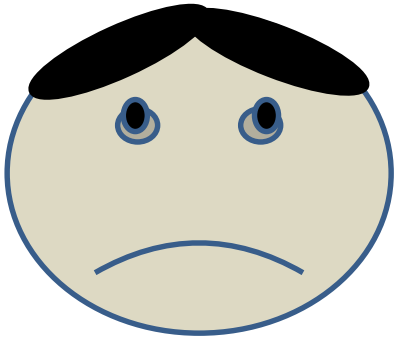
1 – County A



2 – County B

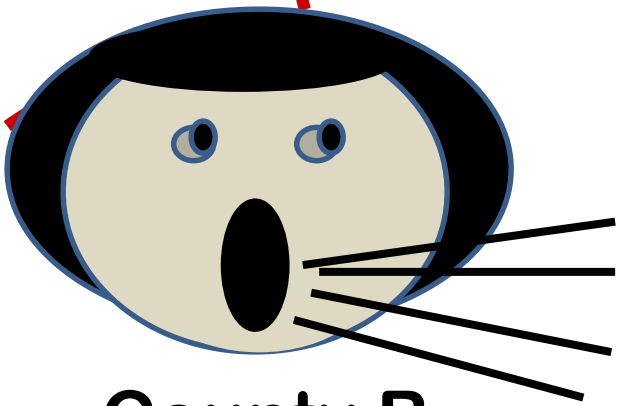


County B

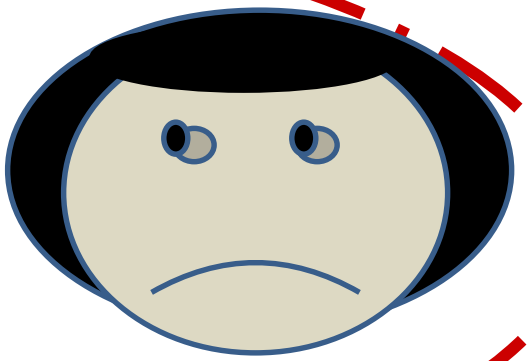


County C

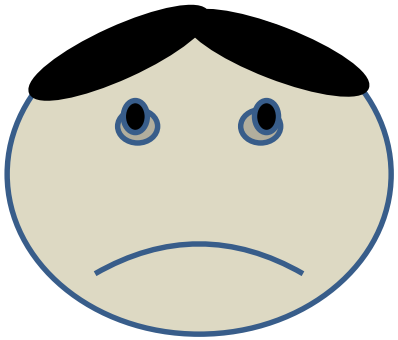
2- County B Alert



County B

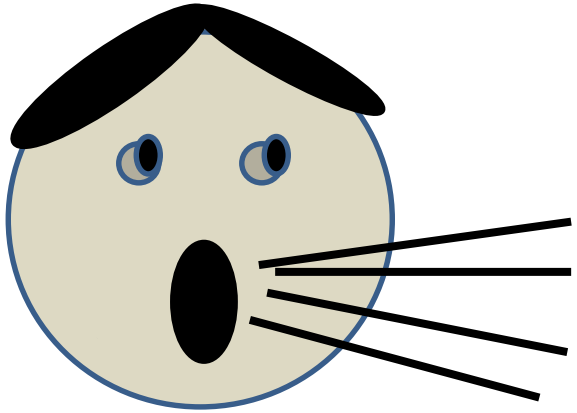


County B



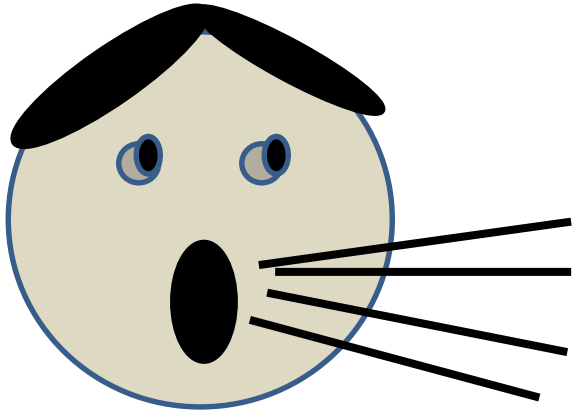
County C

3- County D



County D

3- County D



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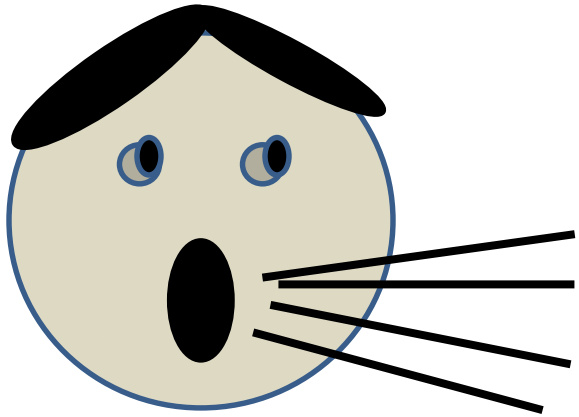
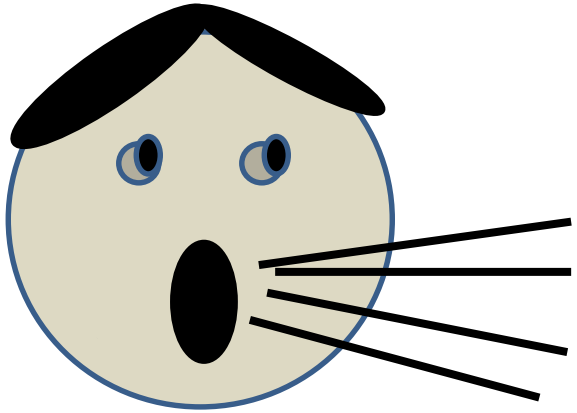


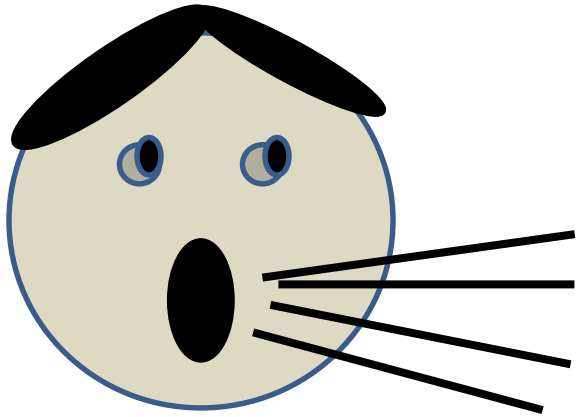
County D

3- Wicomico County



County D

Worried well?



County D

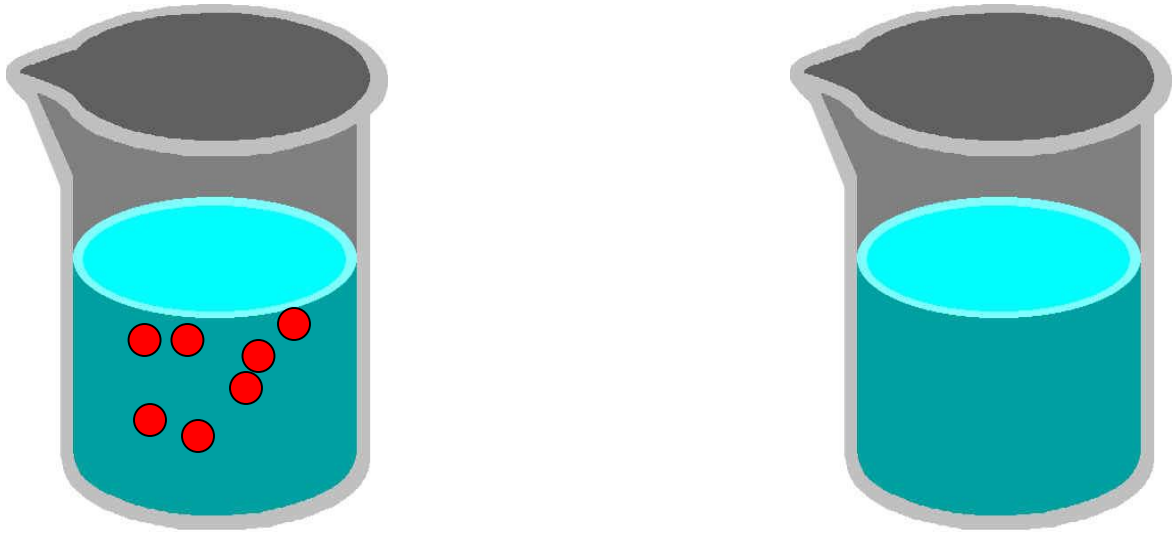
Relapse or exogenous re-infection?

Case	PCRtype	GENtype	Cluster_ name	Genotype Report Date
Homeless outbreak strain	PCR01047	G10248	MD_0002_001	January 2012 – June 2014
Rodney Holmes	PCR17481	G05540		February 2008
Rodney Holmes				(2014)

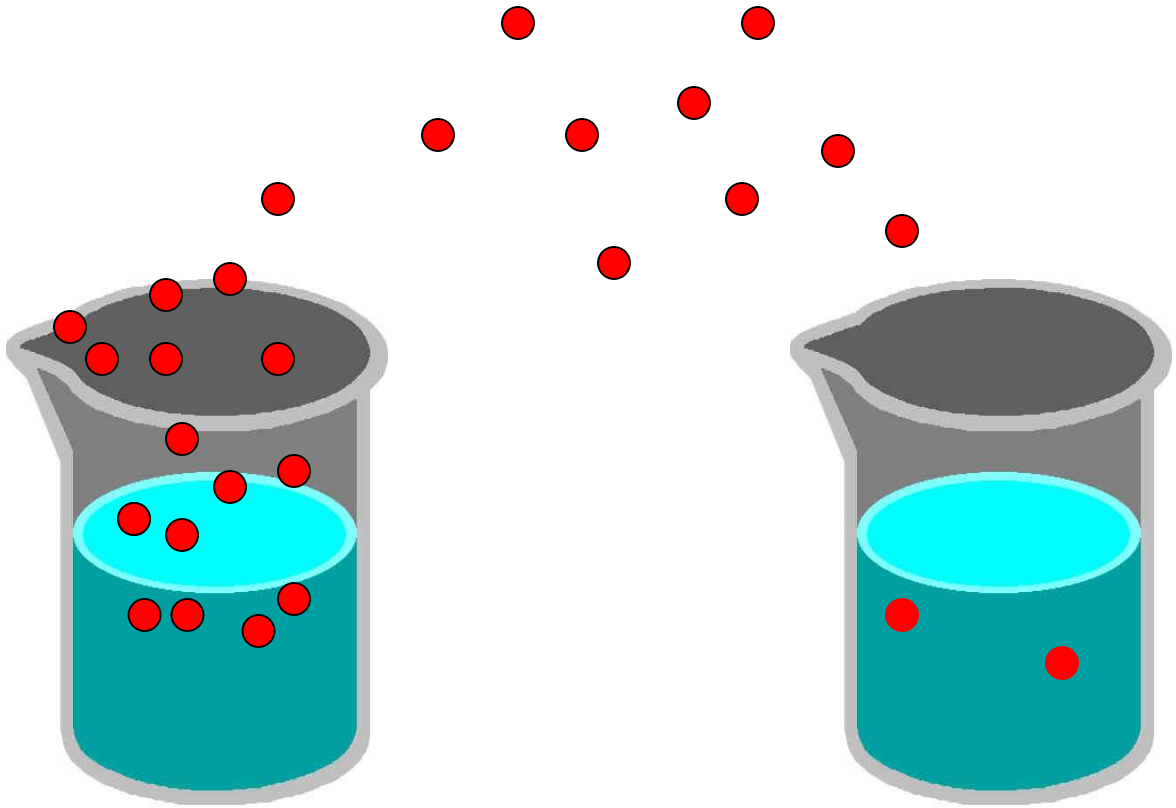
Relapse or exogenous re-infection?

Case	PCRtype	GENtype	Cluster_ name	Genotype Report Date
Homeless outbreak strain	PCR01047	G10248	MD_0002_001	January 2012 – June 2014
Rodney Holmes	PCR17481	G05540	MD_0104	February 2008
Rodney Holmes	PCR17481	G05540	MD_0104	Sept 2014

False Positive Cultures



False Positive Cultures



False Positive Cultures

Causes

- Laboratory cross-contamination
- Clinical device contamination: bronchoscope
- Clerical errors: mislabeling of patient specimens

Consequences

- Incorrect TB diagnosis !
- Unnecessary anti-TB treatment
- Delays in correct diagnosis and treatment
- Overestimation of the TB case rate

Questions?